

would have caused Mr. Whympers's readers to look carefully at the crested larks they saw instead of passing them over as "nearly the commonest birds." Which form is represented in the plate it is difficult to say, but certainly neither the almost black *Galerita cristata nigricans* of the Delta nor the pale, sandy-coloured *G. c. altirostris* found to the south of Cairo could be recognised from the drawing.

Again, on p. 76 the extraordinary statement is made that the red-spotted bluethroat has never occurred on migration in Germany, and that it flies without a halt from Africa to Scandinavia. Because many of the migrants which occur in winter in Egypt are of the same species as those which occur in north-western Europe in summer, it is unreasonable, we think, to suppose that they are the same individuals. The further statement that the bird is but an accidental visitor to Great Britain, and hardly worthy of a place on the list of our birds, should also be corrected, since it has been proved during the last ten years, at all events, to be a regular annual bird of passage in the autumn. We have no wish to criticise unduly, but we think it behoves an author to be even more careful of his facts in a popular book of this kind than in a book intended for readers who would not be so likely to accept his statements unchecked.

The ornithologist reading Mr. Whympers's pages may cull a few observations of interest, such as a note here and there on the winter habits of some of the migrants. The list of birds at the end of the volume is so far from being complete that we cannot think that it has been revised by Mr. M. J. Nicoll, who is credited with having assisted the author in making it 'as complete as possible.'

THE EVOLUTION OF AGRICULTURE.

Die Entstehung der Pflugkultur. By Dr. Ed. Hahn. Pp. viii + 192. (Heidelberg: C. Winter, 1909.) Price 3.60 marks.

IN the study of culture-origins there seem to be three working hypotheses. According to one, institutions and material inventions were, so to speak, "forced" upon man by the various exigencies of his life. "Necessity is the mother of invention." According to another, religion, or rather magic, initiated such steps in progress. A third combines these; a step when made was enabled to persist and be improved by the influence of religion.

But each of these hypotheses, as others, takes into account the psychological factors. How did the idea of an invention occur? It is the first step that counts; given the first step, for instance, in the evolution of the bow, and the rest is easy. How, then, did man hit upon the first step? Among the conditions to be posited are "play" and accident. There is a good deal to be done in the investigation of the first steps of what may be called the primary inventions.

Dr. Eduard Hahn has written many volumes and papers on economic history and culture-origins. He is a suggestive writer, and is always ready with

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a comparison between modern and primitive "diapasons," in Lamprecht's phrase for social atmospheres. The present volume is more or less supplementary, as an answer to criticisms of his theory of the origins of agriculture.

This theory is the magical-religious. It has been severely criticised, and we must admit that in this re-statement and defence Dr. Hahn fails to convince. His method is almost as elliptic as Prof. Adolf Bastian's. A closely reasoned argument confined to one detail, for instance, the relation of the "Moon Goddess" to the evolution of husbandry, and employing careful analogies when a step is taken from one people to another, or from one culture-stage to another, would have had better results. But he seems to rely on the cumulative effect of data which are of the most diverse nature and value. Thus we have in unequal yoke a piece of folklore from Hesiod or Macrobius, with a savage practice of the Australian Arunta and a German peasant custom. But his theory is too fanciful to be able to rely on such data.

The points of the theory are mainly these: the basis of primitive subsistence was vegetable, not animal. The three-stage hypothesis of hunting, herdsman-ship, and husbandry is traversed. The primitive *Hackbau* is distinguished from agriculture proper, *Pflugbau*. Woman was the chief agent in primitive economics, as the "gardener" with her digging-stick. Thus far the theory is sound. But it proceeds to urge the "religious" origin of the domestication of animals, of the use of milk, of the wagon and its wheels, and of the plough, all in connection with the cult of the Moon. Much is made of the sporadic indications of the connection of phallicism with the "idea" of ploughing.

Dr. Hahn's sketch of the primitive symbiosis of Headman, Medicine-man, and Woman is good reading. The Medicine-man protects the primitive "crop" from ghostly enemies, and secures for it ghostly strength. The Headman organises material defence, and, when free, the ordinary male hunts. But primitive society was probably not quite like that; in particular it is easy to exaggerate the influence of "religion."

A. E. CRAWLEY.

OUR BOOK SHELF.

A Manual of Locomotive Engineering. By W. F. Pettigrew. Third edition, revised. Pp. xv + 356. (London: C. Griffin and Co., Ltd., 1909.) Price 21s.

WE had pleasure in noticing the first edition of this book some ten years ago, when a favourable opinion was expressed as to its value as an educational means of assisting students of locomotive engineering in its many phases.

The author claims to have brought the work thoroughly up to date, and, considering the tremendous advances made in this branch of engineering during the last ten or more years, we naturally expect some evidence of really modern practice in the third edition. It is very disappointing to find this is not the case. Plate i. illustrates what the author describes as "the new outside cylinder express engines designed by Mr. W. Adams," &c. As Mr. Adams joined the majority

some years ago, and as the engines referred to were designed many years before then, it is absurd to illustrate them as modern practice when the magnificent creations of Mr. Wilson Worsdell on the North-Eastern and those of Mr. McIntosh on the Caledonian are available.

The compounding of locomotives has also been very seriously considered by many engineers, particularly during the last ten or twelve years. The Webb and Worsdell systems being more or less obsolete, one naturally expected to find the Smith system with three cylinders, which originated on the North-Eastern, engine No. 1619 being the prototype, described and illustrated by one of the recent Midland compounds. Another type of compound represented by the four-cylinder engines on the North-Eastern is conspicuous by its absence.

Of the subject of superheat, which is now being seriously considered by most locomotive engineers, we find no reference in this volume. This is surely a serious omission when there are locomotives running on certain railways in this country fitted with the Schmidt system, a system which claims many economies in working when compared with the heavy boiler expenses involved when working with the high pressures necessary with the compound engine.

Although we have considered it necessary to point out that the author's claim of having brought the third edition of this book up to date has more or less failed, it should be clearly understood that its contents are of a valuable nature, and budding locomotive engineers should obtain a copy without delay. It is certainly one of the best books of its kind. The illustrations are good and the general style excellent.

Matter, Spirit, and the Cosmos. Some Suggestions towards a Better Understanding of the Whence and Why of their Existence. By H. Stanley Redgrove. Pp. 124. (London: W. Rider and Son, Ltd., 1910.) Price 2s. 6d. net.

MR. REDGROVE'S theory of matter is that it possesses only a hypothetical reality; we assume its existence only because otherwise the harmony of our individual worlds would be unintelligible. Spirit, he seems to maintain, we know by direct intuition of ourselves—a proposition of great dubiety, if we take spirit in the sense of real substance. But, granting the one a certain, the other a hypothetical objectivity, the objective relation of the two must be determined. Mr. Redgrove holds that God is the ultimate cause of both, spirit the mediate cause of matter. Yet the effect must be regarded as quite distinct and discrete from the cause. It would seem to follow that for God spirit is something analogous to what matter is to us; but this inference is not drawn. Moreover, no reason is given for the ontological subordination of matter to spirit, except the epistemological distinction noticed above; and it might equally be held to prove the ontological subordination of all other spirits to one's own. Mr. Redgrove, indeed, tentatively holds that in telepathy we have direct "sense" of other spirits; but this perception is "symbolic" as well as direct, which means, one must suppose, that it is not truly immediate. The author believes in the immortality of self-conscious beings; but as he also believes that self-consciousness arises out of protoplasmic consciousness by the ordinary processes of the universe, it is not evident why he should assume the impossibility of a relapse into that state. Though these and other difficulties will be met, the book is well worth reading. Mr. Redgrove writes with precision and force, and his discussion is always interesting.

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LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

The Colour of Water.

I AM reminded by Lord Rayleigh's lecture on this subject of the splendid light-blue colour presented by the tanks of water in which some of the water companies allow the sedimentation to take place of "hard water" which has been treated by Clark's process. I am thinking of those near Caterham and of those at Plumstead. The tanks—to the best of my recollection—are about 20 feet by 40 feet in area and 15 feet deep. The water in the tanks has become perfectly (or nearly) clear, whilst the sides and bottom of the tanks are made brilliantly white by the deposit of calcium carbonate. The intense blue colour is seen at (practically) any angle of vision, and on a sunless, overcast day as vividly as in sunshine. It would be important to ascertain whether the blue colour thus seen is entirely due to the self-colour of the water or whether the phenomenon is in any way due to the minutest white particles of calcium carbonate which are still floating in the apparently clear water, and are acting as do the particles of a blue vapour-cloud. I suppose that it would be an easy thing for a physicist to determine this by the use of a polariscope at the side of the tank.

Also the introduction of black tarpaulin into the tank so as to prevent the reflection of light from the bottom and sides would show whether any amount of blue colour was still exhibited by the water, such colour being then necessarily due to the reflection of light from suspended particles, and not from the sides or bottom. A more satisfactory method would be to draw off (without disturbing the sediment) the blue-looking water into an adjacent tank previously lined with dead-black.

One observation on the colour of water I may venture to record. In a very large porcelain (so-called) bath in a hotel bath-room, where strong sunlight was admitted by a window some 10 feet above the bath, the walls of the room being colourless, I noticed that when the bath was filled to a depth of 20 inches the water had a distinctly blue colour. The porcelain, whilst pure white above, yet beneath the water had a distinctly blue appearance, and the intensity of the colour varied with the movement of the water in waves or ripples. The colour was blue rather than greenish-blue, and this I attributed to the pure white of the porcelain as contrasted with the yellowish tint of enamel. The water in question was that supplied in the Hotel Ritz, in Paris (I think that of the Vanne).

E. RAY LANKESTER.

The Stability of an Aéroplane.

I HAVE been much interested in reading Prof. Bryan's statement on the subject of the stability of an aéroplane, but I cannot agree with him in thinking that the solution of the problem is to come from the mathematical side. I should be the last to decry the use of mathematics in such a case, but if the final result is to be absolutely trustworthy, there must be no doubtful assumptions made during the process.

It does not appear, from the article written by Prof. Bryan, whether he has taken the viscosity of the air into account, but I presume that he has done so. Perhaps, also, his solutions are only meant to apply to the case of an aéroplane flying in a dead calm. The practical difficulty with a flying machine is the natural wind, and if flying machines are to be of any real use they must be able to maintain their stability in ordinary conditions of weather. Now it is obvious that when a flying machine has once left the ground it is quite immaterial to the stability, provided the air motion is perfectly uniform and steady, whether the velocity of the wind be one mile or one hundred miles per hour, since it is only the relative motion of the machine and the air with which we are concerned; but, as a matter of fact, a wind of from ten to twenty miles an hour is fatal to almost every aéroplane, and the